REMARKS

I. INTRODUCTION

In response to the Office Action dated February 13, 2007, claims 20, 22, 23, and 20-30 are amended, and claim 32 is added. Claims 20-32 are now active in this application. No new matter has been added.

II. ALLOWABLE SUBJECT MATTER

The Applicant appreciate the Examiner's indication of allowable subject matter in claims 22 and 26-29, subject to being rewritten in independent form including all of the limitations of the base claim and any intervening claims, and if the 35 U.S.C. § 112 first paragraph rejection is overcome.

Said claims have been rewritten in independent form, with some clarifications, and the 35 U.S.C. § 112 first paragraph rejection is addressed below.

Thus, Applicant submits that claims 22, and 26-29 are allowable.

III. 35 U.S.C. § 112 FIRST PARAGRAPH

Claims 23-29 were rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. This rejection is traversed.

Specifically, the Office Action, at pages 3 and 4, asserts that the specification "does not reasonably provide enablement for optical frequency spacing of more than 4,680 GHz, e.g., 10,000 GHz."

The Examiner has the initial burden to establish a reasonable basis to question the enablement provided for the claimed invention, and "must back up assertions of its own with acceptable evidence or reasoning." *In re Marzocchi*, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971). See MPEP § 2164.04. The Office Action provides no evidence or reasoning regarding why the claimed invention is not enabled for optical frequency spacing of more than 4,680 GHz.

The Office Action, at page 2, Argument (A), asserts that the Examiner "provided reasoning that the claimed invention is not enabled for optical frequency spacing of more than 4,680 GHz, namely 10,000 GHz." Emphasis in original. The Office Action, at page 2, challenges the Applicant to overcome the Examiner's rejection by "pointing to that portion of the specification that enables a frequency such as 10,000 GHz."

However, a mere bald assertion that the claimed invention is not enabled at 10,000 GHz is not a reasonable basis to question the enablement, and is not acceptable evidence or reasoning. **The initial burden is on the Examiner to explain why 10,000 GHz is not enabled to one of ordinary skill in the art.**

Further, it is common in this art to claim bandwidth using an upper limit only, or a lower limit only. For example, U.S. Patent 6,292,288 to Akasaka, in claim 1, states, "signal bandwidth of at least 20 nm." As a second example, U.S. Patent 7,068,943, in claim 3, states, "total dispersion of at least about 100 ps/nm." As a third example, U.S. Patent 7,038,842, in claim 1, states, "a gain level greater than 4 dB. As a fourth example, U.S. Patent 7,039,283, in claim 1, states, "total gain bandwidth of at least 120 nm." Applicants have included the claim pages for the four issued U.S. Patents as attached Appendix A.

As can be seen from the above USP's, the allowed claims contain many numerical limitations. In this technical field, even when one of upper and lower limits are not defined, many applications each exemplifying such fiber characteristics and transmission quality capable of assuring an optical communication have been allowed. An enablement in a limit value ("0" or "∞") is not required. To begin with, the embodiments of these references do not presuppose the use in a limit value. Even when defining both upper and lower limits of a predetermined numerical region has a technical meaning, an application cannot be filed while a limit value cannot be found. That is, Applicant believes it is enough if an enabling embodiment is described in the specification. Namely, in the case that an application clearly contains an enabling embodiment, the application should be allowed even if there is a possibility that the application cannot exclude an unenable case.

In the case of making clear the difference between the prior art and the claimed invention, the numerical region defining only one of upper and lower limits is often cited. If the claimed numerical region not limiting both upper and lower limits is negated on the basis of this fact, the Examiner should explain the criterion for this negation. Because if not so, Applicant has to be forced to repeat the same arguments.

For example, Akasaka, indicated by Examiner, also teaches the incomplete limitations of "signal bandwidth of at least 20 nm" in claim 1, and "limits an amount of gain ripple to 1 dB or less" in claim 54. The Examiner should explain why the handling for the Akasaka reference is different from that for the claimed invention. Also, in the specification, claims 22 and 26 define the wording "does not become lower than 3.5×10^{-20} (m^2/W)", claim 27 defines the numerical region "$m \leq n/2$", and claim 28 defines the numerical region "$m \leq (n+4)2$". Claim 23 defines the wording, an optical frequency spacing between the adjacent pumping channels is not less than

4680 GHz", but this definition should not be considered such that this definition assures an enablement at 10000GHz. The subject matter is not a frequency spacing, but an optical transmission system. Even if this definition contains an impractical value, the invention as defined in claim 23 is sufficiently enabled by selecting a suitable frequency spacing that is enabled in this definition. The specification teaches an enable embodiment, and therefore the skilled person can realize the claimed invention without being fully required with many experiments.

Thus, Applicant submits that the rejection under the first paragraph of 35 U.S.C. §112 for lack of adequate enabling support should be withdrawn.

IV. REJECTIONS UNDER 35 U.S.C. § 102(b) AND 35 U.S.C. § 103(a)

Claims 20, 23, 25, and 30 are rejected under 35 U.S.C. § 102(b) as being anticipated by Akasaka (US 6,292,288). This rejection is traversed.

Claims 21, 24, and 31 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Akasaka (US 6,292,288) in view of Avallone (US 2005/0117839). This rejection is traversed.

Independent claims 20 and 30 recite, in pertinent part, "a transmitter outputting signal light in which an optical frequency spacing between the adjacent ones of a plurality of signal channels is 400 GHz or more but 12.5 THz or less." In addition, claim 20 is added with the feature that at least a part of the pumping channels is located between the predetermined Raman gain peaks as shown in Fig. 19 of the specification.

Anticipation under 35 U.S.C. § 102 requires that "each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ 2d 1051, 1053 (Fed

Cir. 1987). At a minimum, the cited prior art does not disclose (expressly or inherently) the above recited limitation.

The Office Action, at page 3, Argument (B), asserts that the above recited optical frequency spacing is abundantly well known in the art because "Raman signal channels are pump channels and vice versa. It all depends upon how one defines the relative Stokes shift. Further this is clearly disclosed by Akasaka (e.g., figs. 14, 16; col. 1, lines 45-65)." Emphasis in original.

Applicant respectfully submits that Argument (B) is not correct. Namely, as can be seen from Figs. 14a and 16 of Akasaka, an example such that the wavelength of each signal channel is made be corresponded to that of gain peak obtained by the associated pumping channel. As a result, the wavelength of each signal channel is shifted by 13THz (100nm) from that of each associated pumping channel. It is clear that the Raman signal channels are not the pumping channels.

Akasaka merely states "FIG. 63 is a view showing Raman gain profile when a wavelength of a sixth channel is a wavelength spaced apart from a fifth channel by 2.5 THz toward the longer wavelength in the Raman amplifier shown in FIG. 60."

However, in this case, one pumping channel becomes necessary in accordance with one signal channel, and therefore this structure makes DWDM using many signal channels be complex. As considering such a problem, Akasaka's technique as shown in Fig. 63, should be considered as a technique for obtaining a flattened Raman amplification gain spectrum, namely by setting the pumping channel spacing at 6 nm to 35 nm.

Fig. 16 of Akasaka shows the monitoring of one signal channel corresponding to one pumping channel in order to flatten the Raman gain, but does not eliminate the existence of signal channels other than the one signal channel corresponding to the one pumping channel. That is,

there is no reason to limit the number of signal channels to that of pumping channels. In addition, the Raman gain of Fig. 63 is flat, and therefore there is no reason to limit the number of signal channels to that of pumping channels. In the case of DWDM, when the Raman gain is flat, it is clear that the increase of the number of signal channels without limiting the number pumping channels is more preferable as considering the use efficiency of wavelength band.

Akasaka teaches that the wavelength spacing between the pumping channels is 2.5THz, but it does not teach or suggest about the wavelength spacing between the signal channels.

In column 14, lines 17-26, Akasaka teaches "the wavelength of 1435 nm were used as the pumping wavelength of λ1 and λ2 in Fig. 1," and "[t]he power of the input signals is -20 dBm/ch, and the wavelengths are arranged at an even space between 1540 nm and 1560 nm." Further, the related application of WO 00/05622 clearly teaches 8-channel signal light, and Fig. 22 thereof shows eight dots each indicating the associated one channels. That is, the signal light frequency spacing: 20nm/7=2.86 nm (which corresponds to a frequency of approximately 360GHz). Also, this relationship does not satisfy the relationship that one pumping channel corresponds one pumping channel as shown in FIGs. 14 and 16 of Akasaka. Thus, Applicant submits the Argument (B) is not correct.

Claim 20 is limited by the feature of FIG. 19 of "the plurality of pumping channels having wavelengths different from those of the plurality of signal channels, at least a part of the plurality of pumping channels being located between predetermined Raman gain peaks." In contrast, in column 8, lines 1-9, Akasaka describes "the overlapping between the wavelength of the pumping light and the wavelength of the optical signal can be prevented."

Thus, claims 20 and 30 are not anticipated by the prior art, and are not obvious in view of the cited art.

Claim 23 requires three different features: (1) an optical frequency of each pumping channel contained in the pumping light is so set as to locate a peak of Raman gain at an optical frequency different from an optical frequency of each signal channel contained in the signal light; (2) an optical frequency spacing of the adjacent pumping channels contained in the pumping light is not less than 4680 GHz; and (3) at least one of the pumping channels in the Raman amplification pumping light contains a plurality of longitudinal modes. Akasaka does not teach or suggest any of these features.

The Office Action, at page 3, asserts "the Examiner considers Raman amplifiers to inherently Raman amplify. The claimed invention is merely a recitation of the Raman amplification process, which is further disclosed by Fig. 14 . . . Applicant has filed to distinguish the instant invention from Fig. 14 of Akasaka." The Office Action also asserts that the claim limitation "not less than 4680 GHz" has been disclosed.

However, Akasaka, at FIG. 12, merely discloses a frequency spacing of adjacent pumping channels of 6 nm. Thus, it is clear that the recited limitation of "not less than 4680 GHz" does not include the 6 nm of Akasaka.

Additionally, Akasaka does not teach or suggest "said pumping light source outputs the Raman amplification pumping light in which an optical frequency of each pumping channel is so set as to locate a peak of Raman gain at an optical frequency different from an optical frequency of each signal channel contained in the signal light," as recited by claim 23.

Thus, Applicant submits that claim 23 is not anticipated by Akasaka, and is not obvious in view of the cited art.

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are

contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as independent claims 20, 23, and 30 are patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon (claims 21 and 22; 24-29; and 31 respectively) are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

Thus, dependent claims 21, 22, 24-29, and 31 are not anticipated by the prior art, and are not obvious in view of the prior art.

New independent claim 32 recites, in pertinent part, "the wavelengths of the plurality of pumping channels being set such that the plurality of signal channels are located away from the Raman gain peak wavelength by 624 GHz to 1248 GHz."

Applicant respectfully submits that independent claim 32 is not anticipated by the prior art, and is not obvious in view of the prior art.

Accordingly, it is urged that the application, as now amended, is in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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APPENDIX